

THE EVOLUTION OF THE MAP OF  
ALEXANDER AND CHARCOT ISLANDS,  
ANTARCTICA

By

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# THE EVOLUTION OF THE MAP OF ALEXANDER AND CHARCOT ISLANDS, ANTARCTICA

D. J. H. SEARLE

ALMOST A CENTURY separated their discovery, yet Alexander and Charcot Islands have this much in common in their cartographic history: originally only the northern coasts of both were seen and mapped, subsequently both grew in size as further sightings and explorations were made, and now both have, as a result of the compilation of the new map to be described, been pared down in size. The islands lie on the western margin of the British Antarctic Territory, between the relatively well-explored peninsula of Graham Land and the unclaimed and less known sector of Antarctica south of the Pacific Ocean (Fig. 1). They lie beyond the almost permanent pack ice that protects their isolation; although landings have been made on both, neither island has been penetrated and explored. The new map, which reveals many features hitherto uncharted, owes its origin to several expeditions, particularly the Ronne Antarctic Research Expedition (1947-8), which was based outside the area but flew photographic sorties over the islands. So far as is known the air photographs, most of which only recently became available in this country, have not previously been used for detailed mapping. The new map, compiled at a scale of 1:200,000 and drawn and published by the Society at 1:1,000,000, has been compiled largely from them. The map will be found at the end of the *Journal*.

## ALEXANDER ISLAND

### *Nineteenth century exploration*

The discovery and first charting of Alexander Island was in 1821, when Captain Thaddeus Bellingshausen, in command of a Russian expedition despatched by Tsar Alexander I in 1819, first sighted the north-west of the island. Towards the end of January 1821, having discovered Peter I Island farther west, Bellingshausen made a second landfall when the snow-covered mountains of a new land were sighted at a distance estimated to be 40 miles. Dense pack ice prevented a closer approach, but parts of the north-west coast were charted and the discovery named 'Alexander I Land' (Fig. 2a, p. 166). Bellingshausen called '... this discovery "land" because its southern extent disappeared beyond the range of our vision' (Debenham, 1945, p. 420), and considered that he was seeing only part of an extensive land mass.<sup>1</sup>

Nothing was added to Bellingshausen's map until February 1898 when Adrien de

<sup>1</sup> The name 'Alexander', after the reigning Tsar, has been retained, but the number of different versions of the place-name used since original discovery gives some measure of the doubt which has existed about the island's size and nature. In its time 'Alexander' has been suffixed 'Land', 'Island', 'Islands' and 'Archipelago'. In 1842, Dumont d'Urville, leader of the French Antarctic Expedition of 1837-40, referred to Bellingshausen's Alexander I Land as 'Île Alexandre I<sup>er</sup>' (Dumont d'Urville, 1842, p. 10). This was the first time that the term 'island' had been applied, but it may have been used by mistake, since d'Urville had no information to that effect. He was probably influenced by Bellingshausen's map, and since this indicated no connection with any land to south or east, d'Urville assumed that it was an island. In deference to its discoverer's first naming, and in view of its vast extent, the British have always favoured 'Alexander I Land', or, more recently, simply 'Alexander Land'. Since 1942 the Americans have referred to it as 'Alexander I Island' in view of its insularity, which was eventually proved by an American expedition. In order to avoid the clumsy shortened form 'Alexander I I.', and to come to a compromise name, 'Alexander Island' has recently been agreed to by British and American place-name authorities (Antarctic Place-names Committee, 1960).



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Gerlache, in command of the Belgian Antarctic Expedition, was within sight of Alexander Island for a few hours (Belgian Antarctic Expdn., 1899, p. 651). His ship was prevented from approaching nearer than about 40 miles by the pack ice, which both before and since this time has so frequently prevented closer examination of Bellingshausen's discovery. During the short time in which it was visible a sketch map was made of the north of 'la Terre Aléxandre I<sup>er</sup>' (Fig. 2b). Henryk Arętowski, the expedition's geologist, later wrote '... that we made no measurements, and that we have little to add to the description as given by Bellingshausen' (Arętowski, 1901, p. 496). This did insufficient justice to the expedition's hydrographer, George Lecointe, since the map, although sketchy, certainly positioned the coast better and showed more detail than Bellingshausen's had done.

### *Twentieth century exploration*

*Exploration by sea.*—At the beginning of the new century the map of Alexander Island was still in embryonic form, while Charcot Island, lying farther west, remained undiscovered. In 1905 the French explorer, Dr. J. B. Charcot, during his first Antarctic expedition, saw Alexander Island from a distance of more than 60 miles, but, like Bellingshausen and de Gerlache before him, was held off by pack ice and was able to add little to the map (Charcot, 1905, p. 508). One of the primary aims of Charcot's second expedition of 1908–10 was '... gaining further knowledge of the almost unknown Alexander I Land' (Charcot, 1907, p. 217), his intention being to establish a wintering party on the north coast in order to explore inland. Although favoured by a remarkably ice-free year and able to approach to within 3 miles of the coast, no landing was possible because of the unbroken stretch of ice cliffs. However, the opportunity was taken to map, in some detail, the mountain ranges rising behind the north coast.

The map produced after his first expedition indicates that Charcot thought Alexander Island was part of the mainland to the east, for the two were linked by a shaded area implying a land connection (Fig. 2c). After the second expedition this shaded area was removed and, although still called 'Terre Alexandre I<sup>er</sup>', it began to take on the appearance of an island extending some 40 miles from north to south (Fig. 2d). Charcot himself made a shrewd guess when he asserted that, 'there is no doubt that Alexander I Land is a large island separated from the continent by a wide strait' (Charcot, 1911, p. 254). Leaving Alexander Island, Charcot saw '... some high peaks on the horizon, passing behind Alexander Land in the direction of Fallière's Land' (Charcot, 1930, p. 395). He did not realize that these peaks were also on Alexander Island, nor that far from being 'a large island' of 2000 square miles as implied by his map, it was eventually to become one of 20,000 square miles.

*Exploration by land and air.*—In the twenties and thirties of this century the aeroplane began to play its part in the cartographic evolution of Alexander and Charcot Islands. Sir Hubert Wilkins, flying over Charcot Island in 1929, saw Alexander Island from a distance of 70 or more miles (Wilkins, 1930, p. 374). He was obviously influenced by Charcot's map since, seeing mountains to the south of those in northern Alexander Island, he concluded that he was seeing separate islands and drew them as such on his map (Fig. 2e). Alexander Island began to take on the appearance of an archipelago.

Another pioneer of Antarctic flying, Lincoln Ellsworth, crossed south-east Alexander Island on his trans-Antarctic flight of 1935 (Ellsworth, 1937, pp. 193–205). During this flight photographs were taken of Alexander Island and of George VI Sound. The significance of the latter in separating the island from the mainland to the east was not realized at the time, and the resulting sketch map showed an

unbroken coast round Marguerite Bay and an 'Alexander I Land' again merged with the Antarctic continent (Fig. 2f). Later, a re-interpretation of Ellsworth's photographs (Joerg, 1937, map facing p. 444) showed a 'Conjectured Fault Depression'—George VI Sound—separating Alexander Island from the mainland, an interpretation stimulated by the preliminary reports of the British Graham Land Expedition (B.G.L.E.) of 1934-7.

It was from an aircraft flight and a long sledge journey down the ice-filled George VI Sound that the B.G.L.E. surveyor, A. Stephenson, was able to confirm Charcot's impression that, in this sector at least, Alexander Island was separated from the mainland. But, more important, by travelling to 72° South, the sledge party showed that far from being a mere 40 miles from north to south, the island was more than 250 miles long (Fig. 2g). From its farthest south the party was able to see the east coast trending south-west and thus inferred that George VI Sound continued westwards completely separating Alexander Island from the mainland (Stephenson and Fleming, 1940, p. 158). During two other flights by the small aircraft of the B.G.L.E. additional detail was sketched in the northern part of Alexander Island, but the extent and nature of the area west of the Douglas Range remained virtually unknown and unmapped to the present day. Yet during and after the war no fewer than three American expeditions flew photographic sorties in the area and obtained several thousand air photographs: the United States Antarctic Service Expedition (1939-41), the United States Navy Operation Highjump (1946-7), and the Ronne Antarctic Research Expedition (1947-8).

In December 1940 two members of the first of these three expeditions, Finn Ronne and Carl Eklund, sledged to the western entrance of George VI Sound and so confirmed at last that the island was separated from the continent (Ronne, 1945, pp. 13-22). Had this expedition been based on Alexander Island as was planned, the area west of the Douglas Range would have been explored, but since a landing on the island was impossible, as it had proved to Charcot thirty years before, a base was established instead on Stonington Island in Marguerite Bay. The expedition aircraft made a number of flights, including several over Alexander Island, but the resulting air photographs have never become available in this country.

The next American expedition, the United States Navy Operation Highjump, operated from ships in the Bellingshausen Sea for a short time during the 1946-7 Antarctic summer, and again photographic flights were made over Alexander and Charcot Islands (Byrd, 1947). In 1947 also, Finn Ronne, one of the two men who had proved the insularity of Alexander Island, returned to Stonington Island with his own venture, the Ronne Antarctic Research Expedition (R.A.R.E). Being airborne throughout, Ronne was able to extend his explorations some hundreds of miles beyond his previous limits (Ronne, 1948). Among other flights, he retraced his route of seven years before through George VI Sound, and flew three times over the interior of Alexander Island (Fig. 2h). In all, some 15,000 air photographs were obtained, 3000 of which were of potential value in mapping the island. It was the photographs from this expedition together with a few from Operation Highjump that were used in 1959 and 1960 to compile the new map. The value of the photographs for mapping purposes was considerably diminished since little ground control was established. The only maps known to have been drawn from them hitherto are at scales of 1:1,000,000 and smaller, no more detail being plotted than coastline and larger mountain ranges. As a result of this mapping, Alexander Island attained the greatest area in its cartographic evolution; by a prolongation of the south-west extremity to 76° 30' W it reached the unprecedented area of about 25,000 square miles (Fig. 2h).

Before the new compilation from air photographs, the most recent additions to the map were made in 1948 and 1949 by C. C. Brown and V. E. Fuchs, members of the British Antarctic Survey (known then as the Falkland Islands Dependencies Survey), sledging in George VI Sound (Fig. 2j) (Fuchs, 1951). As with the B.G.L.E. surveys, the area seen and mapped, except in the comparatively featureless south-east corner of the island, was limited to a few miles inland by the 9000 foot Douglas Range running parallel with the east coast. The blank areas on the map west of these mountains gave rise to an erroneous impression that the west side of the island was one huge ice piedmont sloping down from the Douglas Range to the sea. This impression was fostered by the assumption that Alexander Island was a morphological parallel to Anvers and Adelaide Islands farther north, both of which were already known to have high mountains on their east sides from which, in each case, an ice piedmont extended to the west coast. The new map shows that west Alexander Island is far from being an empty ice piedmont, but contains instead extensive mountain areas and numerous nunataks (Plate 1, Fig. 3).

### *Air photography*

One of the Ronne Antarctic Research Expedition aircraft was equipped for trimetrogon photography, a method that was developed extensively for mapping the Canadian and United States arctic territories. It is valuable in the production of reconnaissance maps of country where weather suitable for flying and photography may occur on only a few days in a year, and where cartographic accuracy takes second place to speed of map production. It is also a relatively economical method compared with vertical photography. A trimetrogon assembly, as the name implies, uses three cameras, one operating vertically and the other two obliquely, to photograph a strip of country shaped rather like an hourglass, extending from horizon to horizon at right angles to the line of flight of the aircraft. A vastly greater area can therefore be photographed on a single flight with trimetrogon cameras than with a camera operated only vertically. A vertical photograph taken from a height of 15,000 feet might cover only 16 square miles; at the same height an oblique camera could theoretically 'see' 130 miles to the horizon, and its field of view would cover over 10,000 square miles. There are, of course, limitations to this theoretical photographic coverage, the most obvious being that little ground detail farther away than 50 miles would be of use to the map compiler, and that in anything but flat country there would be areas of dead ground, the proportion increasing with the amount of relief.

The usefulness of either vertical or trimetrogon air photographs for map making depends largely on whether ground survey control exists to position the detail accurately on the earth's surface, and also whether sufficient detail appears on the photographs to allow them to be linked together. The Antarctic, by its nature, makes both conditions hard to satisfy; the difficulties of travel and the vagaries of weather impede the surveyor, while extensive areas of featureless snow appear devoid of all detail on the photographs, which are therefore useless for systematic map making. The air photographs of the R.A.R.E. inevitably suffered from these limitations, although at the time they constituted one of the most continuous and useful sets of their kind obtained in polar regions.

### *Compilation of the new map*

A full account of the techniques used in mapping from these photographs appears elsewhere (Searle, 1961). The fundamental problem was to position the photographs by reconstructing the flight lines from the evidence on the photographs

themselves, since few other data were available. The Minor Control Plot method, in which vertical photographs are linked together to form a continuous traverse correct in scale and azimuth, worked well enough for positioning the flight lines over George VI Sound and on the east coast of Alexander Island. Here the photographs overlapped sufficiently and bore plenty of ground detail, some of which had been fixed by previous ground survey. As the aircraft flew into Alexander Island, overlap was reduced to below the required minimum and areas of cloud or featureless snow were crossed. Consequently the Minor Control Plot broke down, and scale, azimuth and position were lost. In the absence of any ground control, apart from a little in George VI Sound (Fig. 3), methods of reconstructing flight lines had to be improvised. In some cases it was possible to derive azimuth alone from a modification of the Minor Control Plot method, while scale had to be estimated. When azimuth also was unobtainable from the verticals, the amount of aircraft tilt, measured from the obliques, was translated somewhat unconventionally into change of direction.

Some assistance in positioning the three R.A.R.E. flight lines over Alexander Island was derived from the fact that they crossed each other in six places (Fig. 3), four of which were identified on vertical photographs. The other two, although occurring over featureless snow, could be located to within a mile or two by detail on the obliques. The pattern of flight lines resulting from these improvisations was treated as a trellis fixed only by the control in George VI Sound, and free to pivot in the six crossing places. The trellis was then expanded, contracted and swung until the best compromise was obtained. This trellis acted as a framework on which to hang the abundance of detail obtainable from the obliques (Plate 1). A network of control points was obtained by a system of intersected bearings similar to that used in a compass traverse. An azimuth grid, constructed on transparent medium, was laid over the oblique photographs, and bearings to previously selected prominent points were read off and transferred to the plotting sheet. Bearings to the same control points from different photographs gave the necessary intersections. Stereoscopic examination of the obliques then indicated the topographical detail to be sketched between the control points. As a result Alexander Island has been reduced to under 20,000 square miles, and the country west of the Douglas Range—more than three-quarters of the island—has appeared on the map in detail for the first time (Fig. 2k, Fig. 3).

#### CHARCOT ISLAND

There had been a certain amount of ground control to help in the compilation of the new map of Alexander Island, but none was available on Charcot Island. Discovered by Dr. Charcot in 1910, it was named 'Terre Charcot' after his father, and was considered to be part of the mainland (Charcot, 1911, p. 254). A belt of close pack ice, estimated at the time to be 30–40 miles wide, prevented more than a distant view of the discovery, although there is evidence now that Charcot may have been closer to it than he realized. The first appearance of the new land on the map was merely as a north-facing coast, some 50 miles from east to west, with three prominent isolated summits rising to 1800–2000 metres a few miles inland (Fig. 2d).

*Exploration by air.*—The next sighting of 'Terre Charcot' was in 1929 when Sir Hubert Wilkins flew round it, thus proving it was an island and not part of the Antarctic continent (Wilkins, 1930, p. 376). The name was changed to 'Charcot Island' and has remained so ever since. During the flight several hand-held random photographs were taken, all of those published being of the north and east coasts. The resulting sketch-map showed the island to be some 2500 square miles and of

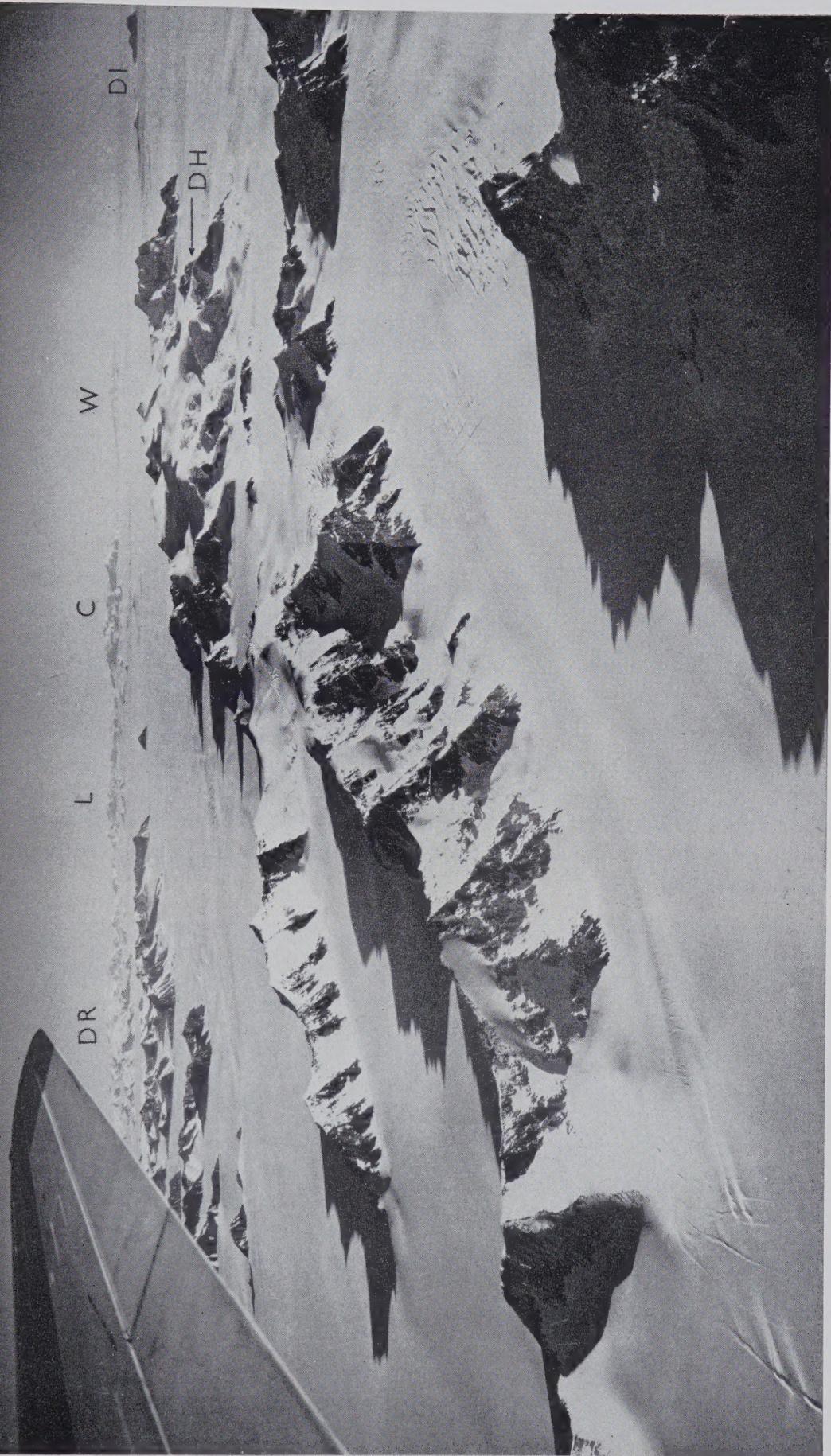
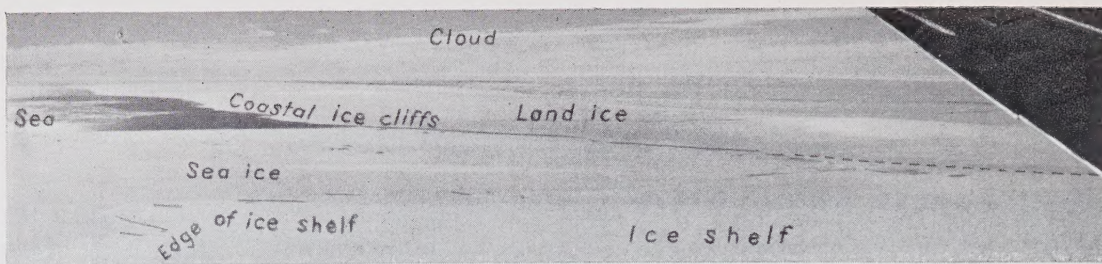
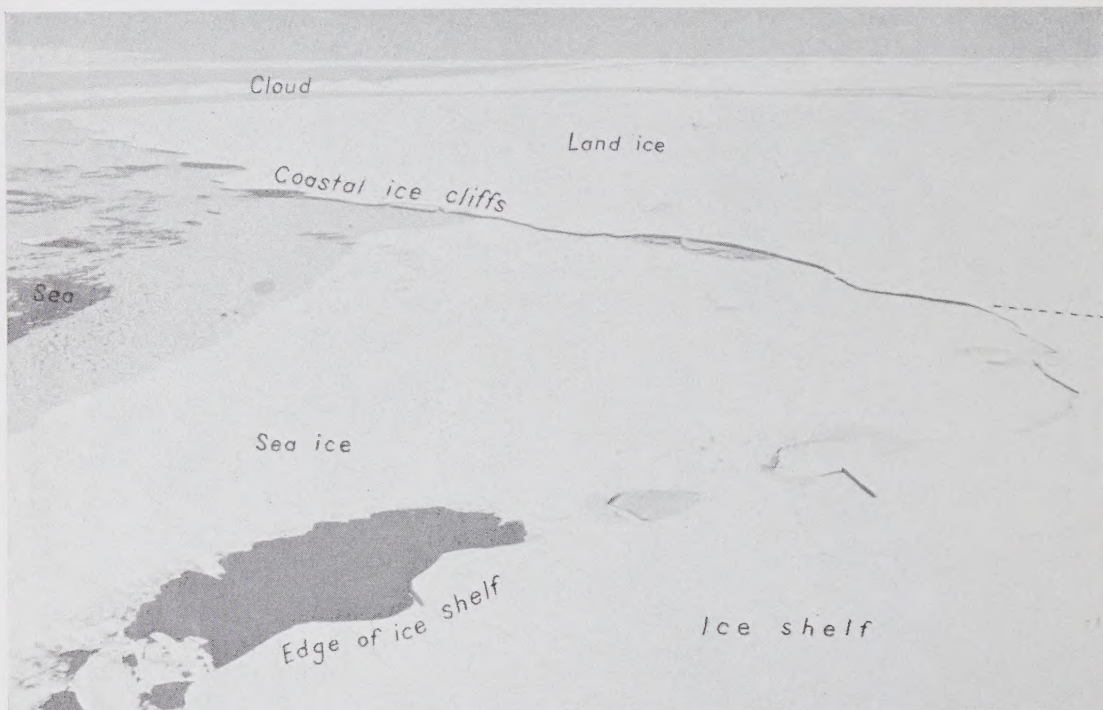


Plate 1. Part of an oblique air photograph from the Ronne Antarctic Research Expedition showing west Alexander Island. This view, looking slightly east of south from about  $69^{\circ} 33' S$ ,  $71^{\circ} 43' W$ , was taken during the return to base after the landing on Charcot Island  
DR Douglas Range, L Lemay Range, C Colbert Mountains, W Walton Mountains, DI Dorsey Island, DH Debussey Heights (see Fig. 3)

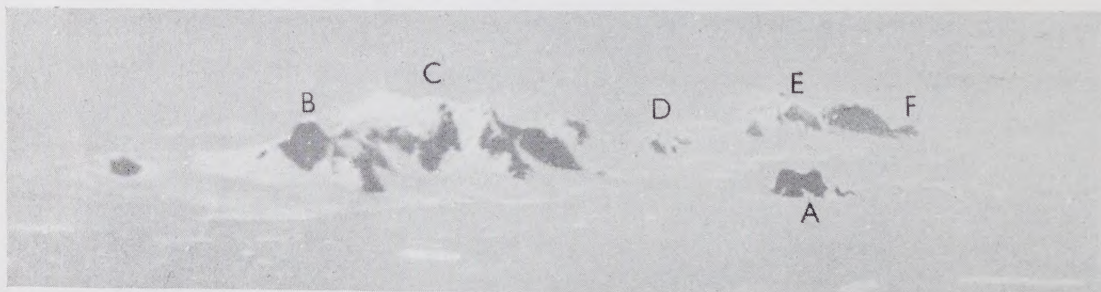


2a. The south coast of Latady Island (the 'false Charcot Island') from a Ronne Antarctic Research Expedition oblique air photograph

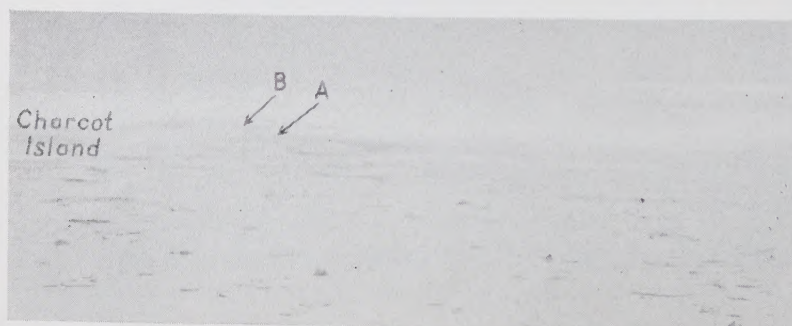


2b. The south coast of Charcot Island from an Operation Highjump oblique air photograph

The above views illustrate the apparent similarity in the south coasts of the two islands. The broken line in both photographs indicates the junction of land ice with ice shelf

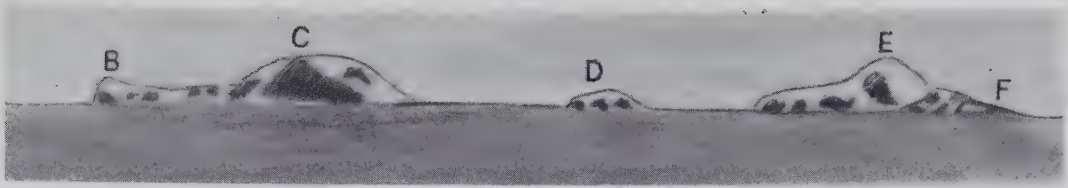


2c. A photograph looking west along the north coast of Charcot Island taken by Sir Hubert Wilkins (Wilkins, 1930, Fig. 22, p. 375)

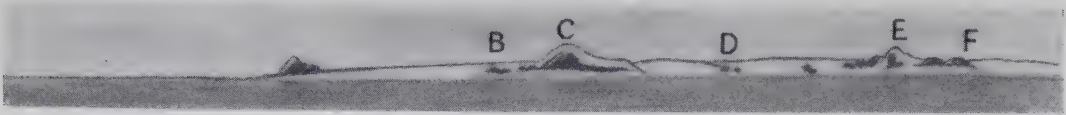


2d. Charcot Island from about 35 miles eastward from an Operation Highjump photograph, taken by the same camera and on the same sortie as 2b above

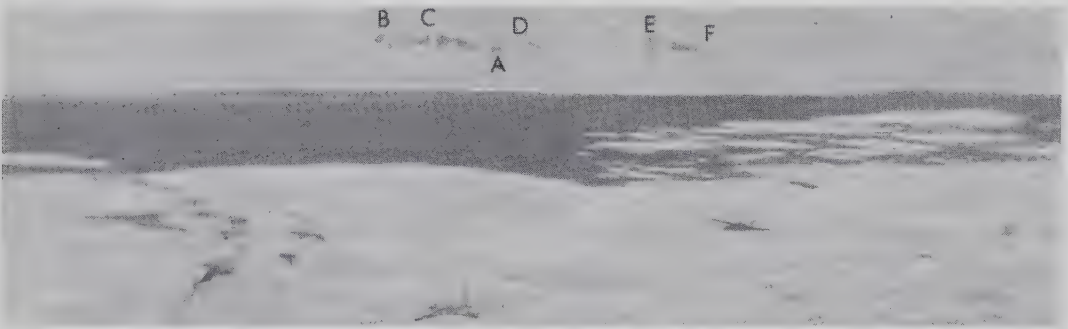
Points of rock detail common to c and d above and to Plate 3 are lettered A, B, C, D, E and F



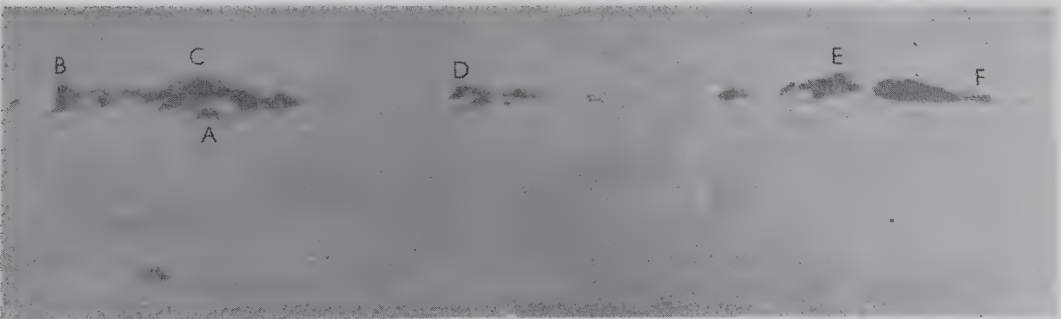
3a. Sketch by Dr. J. B. Charcot, 1910 (Charcot, 1930, Fig. 1, p. 389)



3b. Sketch by Lieut. Bongrain, 1910 (Bongrain, 1914, vue 44)



3c. Photograph by Sir Hubert Wilkins, 1929 (Wilkins, 1930, Fig. 19, p. 375)



3d. Photograph by Sir Hubert Wilkins, 1929 (Wilkins, 1930, Fig. 20, p. 375)

Plate 3. Sketches and photographs of the north coast of Charcot Island seen from the north. Common points of detail are lettered A, B, C, D, E and F; see also Plate 2c and 2d

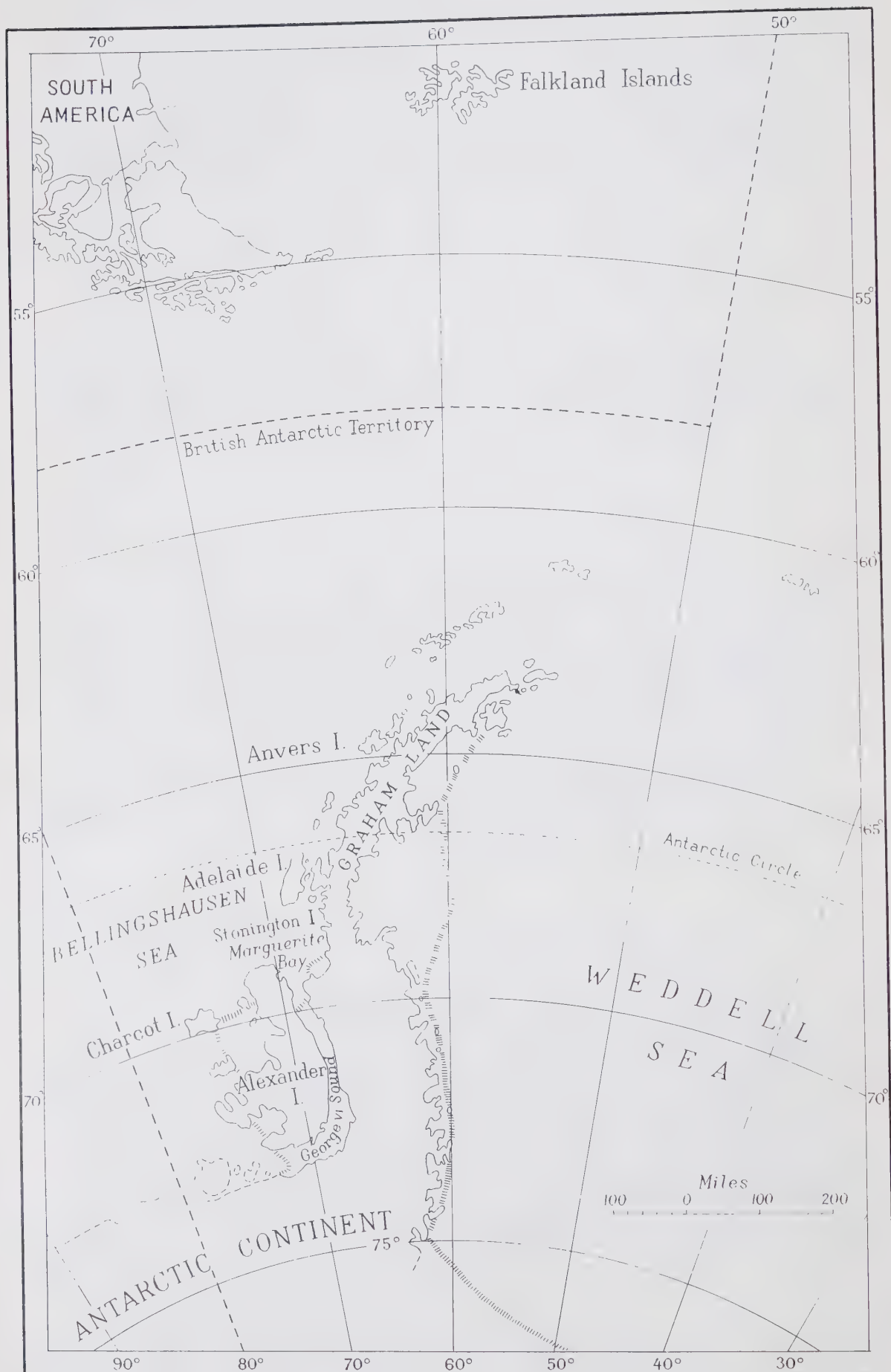


Figure 1

'ham-shaped appearance' (Fig. 2e) (Wilkins, 1930, p. 376), this version remaining virtually unchanged until the new map was compiled.

All subsequent expeditions working in this area have been American. Had it been possible to land the wintering party of the United States Antarctic Service Expedition (1939-41) on Alexander Island, the true nature, position and size of Charcot Island might have been determined twenty years ago. Instead it was seen only from the air. In February 1947 ships and aircraft of the United States Navy Operation Highjump were operating in the Bellingshausen Sea. This expedition experienced poor weather during the few days spent in the area, but several photographic flights were made along the north and east coasts of the island (Fig. 3). The resulting air photographs are of little value in systematic mapping; much of the detail on them is obscured by cloud; they were taken from a remarkable variety of flying heights, from 500 to 15,000 feet; moreover, although a trimetrogon assembly of cameras was fitted in at least one of the aircraft, in all but a single true trimetrogon run only one oblique camera and occasionally the vertical were operated, the interval between exposures being irregular and overlap between successive photographs absent. Most of these obliques were taken with a camera which must have been free to point in all directions, since port and starboard wings and tailplanes appear on different 'left oblique' (*sic*) photographs from the same run. It was clear that if use was to be made of these photographs they would have to be treated as of the 'snapshot' variety.

The air photographs of the Ronne Antarctic Research Expedition of 1947-8 promised to be much more useful in re-mapping Charcot Island. The flight diagram of the photographic sorties indicated that the aircraft had flown across the south coast of the island before the cameras were switched off (A.A.F. Sheet 1789). Ronne and his two companions then brought the aircraft down on the island, thus becoming the first to land on it. The cameras were not switched on again after take off until the aircraft was approaching Alexander Island, some 50 miles away.

#### *Compilation of the new map*

*One island or two?*—There were available, in fact, 200 or 300 air photographs allegedly taken of Charcot Island. It was decided to make a beginning from the R.A.R.E. photographs since their value had already been proved in Alexander Island. The flight line crossing Charcot Island was reconstructed using the vertical photographs. This confirmed that the last photograph before the cameras were stopped was taken within a few miles of the position indicated on the flight diagram, that is, a few miles north of where the maps showed the south coast of Charcot Island to be (Fig. 2h). Examination of the photographs, however, disclosed inconsistencies between them and the flight diagram. Throughout this section of the flight, until the cameras were switched off, the photographs show the aircraft was actually flying over ice shelf, although according to the flight diagram the last seven photographs were taken above Charcot Island. About 70 miles before the last photograph the ice cliffs of a south-facing coast appear on the left obliques as if approaching Charcot Island. The aircraft did not cross this coast, however, which instead trended northwards for ten miles parallel with the aircraft's course (Fig. 3). The north coast of this land was then also passed, the photographs showing the coastline to be unbroken ice cliffs and the land itself a low featureless snowfield. The prominent north coast peaks on Charcot's map (Fig. 2d) and sketches (Plate 3a and b), which Wilkins's photographs confirm (Plate 3c and d), were not there. Clearly this was not Charcot Island although its north coast coincided roughly with the position hitherto assigned to the south coast of Charcot Island. It could only be another island, unmapped, unreported even, perhaps 40 miles from east to west and 10

miles wide. The cameras on this flight were functioning for about 20 miles north of this 'false Charcot Island' (now named Latady Island) but, apart from an indistinct white line on one of the last left obliques, a line which might be ice cliff or equally might be pack ice or even cloud, the photographs show no south coast of the true Charcot Island; instead they show only the ice shelf edge running northwards a few miles west of the aircraft.

It is now clear that two quite separate islands exist, although as both do not appear on any one set of photographs—Wilkins's, Operation Highjump or R.A.R.E.—this interpretation was slow in emerging. It was further delayed and confused by the similarity in appearance of the south coasts of the two islands (Plate 2*a* and *b*). For some time a coastline on the Highjump photographs was taken by the writer to be the south coast of the 'false Charcot Island' because of its similarity to the view on the R.A.R.E. photographs. A considerable effort was made to reconcile the positions of the two sets of photographs which, from independent plotting, showed a discrepancy of 70 miles. The solution to this problem was finally found when examination of the prints showed that the coastline on this Highjump sortie clearly belonged to the same land as a distant rock exposure about 60 photographs farther north. This rock exposure, hidden by cloud on all but a few prints, was eventually recognized to be the same as one appearing on Wilkins's photographs (Plate 2*c* and *d*). There was no doubt that Wilkins's photographs were of Charcot Island, so it followed that this Highjump coastline must be the south coast of the *true* Charcot Island and not the 'false Charcot Island' as shown on the R.A.R.E. photographs.

*The position and size of the islands.*—Once it was evident that Charcot Island did not appear on the R.A.R.E. photographs, the problem of its location resolved itself into three possibilities (i) that earlier maps showing Charcot Island extending from  $69^{\circ} 45'$  to  $70^{\circ} 30'$  South were correct, but that the photographs from the R.A.R.E. flight approaching it were taken at least 35 miles south of the position assigned to them by both the writer and Ronne; (ii) that the position of these photographs was correct, but that Charcot Island lay at least 35 miles north of its previously plotted position; (iii) that the positions of both the north coast of Charcot Island and the photographs were approximately correct, but that the island was not nearly as extensive as Wilkins had thought, and did not, in fact, extend south of latitude  $70^{\circ}$ . Any one of these three possibilities would account for the island's absence from the R.A.R.E. photographs.

The first possibility, that the true position of these R.A.R.E. photographs is at least 35 miles farther south, is untenable, since their present position is confirmed by several relatively well-fixed features which appear on the same photographs. The most conclusive evidence lies in the last few obliques taken before the trimetrogon cameras were switched off prior to the landing on Charcot Island. On the left obliques appear first the 'false Charcot Island' and then the sea and ice shelf north of it; on the corresponding right obliques appear Dorsey and Rothschild Islands, first seen and mapped by the United States Antarctic Service Expedition and Charcot's second expedition respectively. The earlier positions of these two islands are confirmed by the new map, and a miscalculation of 35 miles in the aircraft's position is therefore not possible.

The second possibility, that Charcot Island lies 35 miles north of its previous position, is equally unacceptable. Were this so, it would be surprising that neither Bellingshausen nor de Gerlache sighted the north coast summits, which would have been within 40 miles of their ships. However, since Charcot made only one brief sighting of the north coast, its position could not have been derived from cross bearings, but must have been calculated from the angle subtended by the coastal

ice cliff; 'En supposant à cette falaise la hauteur normale moyenne de 30 à 40 mètres . . . , la Terre Charcot se trouvait entre 30 et 40 milles de nous' (Bongrain, 1914, p. 53). A small error in estimating the height of the ice cliff would give a disproportionately large error in the position of the coast, as was recognized by Charcot's hydrographer, Lieutenant Bongrain, who claimed little accuracy for the position: 'La Terre Charcot, que nous n'avons pu voir que quelques heures et à grande distance, n'est placée qu'approximativement en latitude sur nos cartes' (Bongrain, 1914, p. 53). Yet Sir Hubert Wilkins confirmed the position of the north coast to 'within five miles' (Wilkins, 1930, p. 373), an estimate based on flying time from his ship some 150 miles to the north, and by bearings to Rothschild Island and 'Mt. Havre on Alexander Land'. Calculation of distance based on flying time is notoriously subject to error, while a bearing to 'Mt. Havre', a massif 15 or more miles long, could not be very precise, and too much weight cannot therefore be given to Wilkins's position. In spite of this, all the evidence does add up to confirm that the true latitude of the north coast of Charcot Island is no more than 10 miles north of the position assigned to it by Charcot.

If it is now accepted that the north coast of Charcot Island lies no more than 10 miles north of its previously charted position, and that the R.A.R.E. photographs have been plotted approximately in their correct position, then the third possibility, that Charcot Island is considerably smaller than shown on all previous maps, must also be accepted. In compiling the new map of Charcot Island this deduction has been used to reduce the north-south extent of the island from the original 55 miles to 25 miles, and the area from 2500 to 700 square miles. The north and south coasts have been re-positioned 10 and 40 miles respectively farther north. The evidence for the revised position of the south coast comes in the last R.A.R.E. photographs approaching Charcot Island. On these the sea can be seen extending to about latitude 70° South, indicating that the south coast must lie north of this. The approximate position and extent of the almost featureless east coast is now plotted from the same photographs of Operation Highjump which finally provided the link with those taken by Wilkins. On this true trimetrogon sortie of Operation High jump Charcot Island appears on the left obliques, Dorsey and Rothschild Islands on the right obliques, adding further evidence for this revision to both the size and position of Charcot Island. The 50 miles over which the island's north coast stretched according to Charcot and Wilkins has also been reduced to about 30 miles by a less conventional method. This had to be improvised because only random photographs were available, although over limited distances the detail they showed overlapped sufficiently for them to be linked together and features to be plotted in their correct relative positions. One oblique taken from an altitude of about 1000 feet was a 'close up' of Mount Monique rising almost sheer out of the sea. On the evidence given in the following section the height of the mountain was taken to be 2000 feet and the distance from sea level to this summit was measured on the photograph, although the summit itself was in cloud and its position had to be interpolated from another photograph. This vertical measurement was then turned horizontally so that it fitted over two prominent points of coastal detail. The same two points were found on photographs of a flight running parallel with the north coast but at a greater distance from it, and the 2000 feet measurement was 'stepped off' in each direction on the photographs until the north coast took a southerly trend at its two ends. This method, although a crude one, indicates that the island is probably not more than 30 miles from east to west. There were no Highjump photographs of the west and south-west parts of the island, so that the shape of these coasts as plotted by Wilkins has been modified to fit the new map.

A convincing reason for the discrepancy in size of Charcot Island on Wilkins's map and on the new map is not apparent. One is tempted to think that the ice shelf which, in 1947, joined Charcot Island to the 'false Charcot Island' only at their eastern extremities covered much more of the sea between the two islands eighteen years previously, and that Wilkins flew round both islands assuming them to be one. This might account for the wide bay reported by Wilkins on the west coast of Charcot Island. However, had he covered this area he must have considerably underestimated the distance flown, and therefore it seems more likely that, in common with many exploratory flights, distance covered was rather over-estimated and consequently the size of Charcot Island exaggerated.

Latady Island (the 'false Charcot Island'), plotted by bearings from the same R.A.R.E. photographic sortie which crossed south-west Alexander Island, is probably more accurate in relative position than Charcot Island itself, although since all the photographs were taken from beyond its eastern end, its western shape and limits can be little more than a guess. Absolute position throughout this whole area is not reliable.

*The Charcot Island mountains: height and number.*—Two further anomalies from earlier maps remained to be resolved: the height of the mountains on Charcot Island and the number of major summits. Charcot's hydrographer, Lieutenant Bongrain, stated that the summits were 1800–2000 metres (5900–6500 feet) high (Bongrain, 1914, p. 53). Yet Wilkins, flying at only 2500 feet, estimated the peaks to be 500 feet below him (Wilkins, 1930, p. 374), but neither he nor Charcot subsequently commented on this discrepancy. Estimation of height from an aircraft equipped with an altimeter carries more conviction than observations from a ship across 30 miles of ice-filled sea. In fact, as it seems probable that Charcot's ship was nearer the island than was realized at the time, this alone would account for some exaggeration in the heights calculated, while possibly the intervening pack ice caused conditions of abnormal refraction which served to accentuate the angle of elevation. Wilkins's estimate is confirmed by the Operation Highjump photographs. Although the flying height from which these were taken is not known exactly, it is evident that the summits are of no great altitude and certainly did not tower 6000 feet above the aircraft when it was flying near sea level close under the mountains. Ronne's photographs also confirm this. On the two occasions when obliques were taken in the direction of Charcot Island from over Alexander Island, some 80 miles away, a layer of cloud blanketed the area west of Alexander Island. Over Rothschild Island the upper limit of the cloud was at 2500–3000 feet, since a peak of about 3000 feet protruded through it. Unless the upper surface of the cloud sheet rose westward it would appear that the peaks of Charcot Island do not exceed 3000 feet, since none appears above the cloud.

It has become traditional to imagine Charcot Island with three peaks, Mounts Marion, Monique and Martine, rising in isolated grandeur from the north coast. All subsequent maps had reproduced what appeared on Charcot's original (Fig. 2*d*), these three peaks remaining virtually unchanged, so that it was something of a surprise to find convincing evidence on both Wilkins's and the Highjump photographs that there were only two mountains. Bongrain, who compiled the expedition map, mentions three summits in his report (Bongrain, 1914). This is confirmed by his sketch (Plate 3*b*) which shows two mountains with a considerable amount of bare rock on their north-facing slopes and a few nunataks between them, and a third mountain farther east which appears to be completely snow-covered and to lie back from the coast. Both Wilkins and Ronne claimed to have recognized 'Charcot's three peaks', yet Charcot, quoting from his private journal written at the time of

discovery, said 'We make out two high mountainous masses, from which black rocks emerge, and between them a smaller mass . . .' (Charcot, 1930, p. 395). This description, and an accompanying sketch (Plate 3*a*) drawn at the same time as Bongrain's, fit the latter's central and western summits with the nunatak area between them; there is no indication of a third snow-covered eastern summit in Charcot's description or sketch. In 1930, after photographs from Wilkins's flight (Plate 3*c* and *d*) had confirmed Charcot's own description and sketch (Plate 3*a*), Charcot wrote, 'The three peaks . . . have been recognized and are the only bare land protruding from the ice cap' (Charcot, 1930, p. 394). It is clear that the nunatak area between the two mountains was regarded by Charcot as being the third summit, and that all three had patches of bare rock.

One can only speculate on the origin of Bongrain's Mount Martine, the isolated eastern summit. It has already been suggested that measurement of angles at that time may have been affected by abnormal refractive conditions, and it is therefore interesting to note that roughly on the same bearing from Charcot's ship lie the Colbert Mountains in western Alexander Island (Plate 1 and Fig. 3). These mountains are estimated by the writer to be 7000–8000 feet high and form a massive and almost entirely snow-covered range. Although well over 100 miles from the ship, it is not impossible that Bongrain saw their summit and assumed it to be on Charcot Island; indeed it is this that would have led him to exaggerate the extent of the north coast of the island in order to accommodate his eastern summit.

#### CONCLUSION

The result of this work with the American air photographs has been to re-compile the map of a sizeable part of the British Antarctic Territory. A scale of 1:200,000 was chosen for convenience, since the re-compilation was to be incorporated into the current British series of maps of this sector of the Antarctic (D.O.S., 1956–8). Although the bulk of the map was compiled without ground control, it was only the availability of the control established by the British Antarctic Survey and British Graham Land Expedition surveyors in George VI Sound that allows of any confidence at all in the scale and position of features distant from the ground survey. This ground survey varies from the highly reliable mapping of the north-east coast of Alexander Island to the exploratory surveys by the B.G.L.E. in the central parts of George VI Sound, and by British Antarctic Survey geologists in its southern parts. Consequently the compilation from air photographs varies in a similar manner, being most reliable in the areas adjacent to north-east Alexander Island, and somewhat less so in those areas adjoining the central and southern parts of the Sound. The most significant falling off in reliability is, however, from east to west across the whole map. Compilation proceeded in this direction, and as the ground control of east Alexander Island was left behind there was no way of checking scale and azimuth of the plotting. Accumulated errors might mean that on the west coast of Alexander Island there may be positional inaccuracies of 15 miles. By the time the western limits of the map are reached these errors might amount to 20–25 miles, although evidence from independent sources—Charcot, Wilkins, Operation Highjump and R.A.R.E.—suggests that this is a pessimistic assessment, and that the western islands are probably plotted within 10 miles of their true position.

This whole area will doubtless one day be as well known and well mapped as parts of Graham Land are at the present time. This will not be, however, until a tremendous amount of land travel has been done, a network of ground survey established and a coverage of air photography obtained. In the meantime the area preserves its isolation; as recently as 1960 an attempt by the British Antarctic Survey

to establish a base in George VI Sound was frustrated by pack ice in Marguerite Bay. In order to plan for the establishment of bases and for land travel, for ground survey and air photography, maps are an essential. It is hoped that this new map will assist such planning. It is claimed to be nothing more than a sketch map, the accuracy of which varies greatly in different parts and on which only the larger and more outstanding mountains, glaciers and nunataks have been shown. Nevertheless, it will indicate, to those whose privilege it will be to travel and survey west of the Douglas Range, the nature of the country, the likely routes to follow and the larger obstacles to avoid. If it does nothing else it will suggest the amount of interest and work there for surveyor, geologist and geographer.

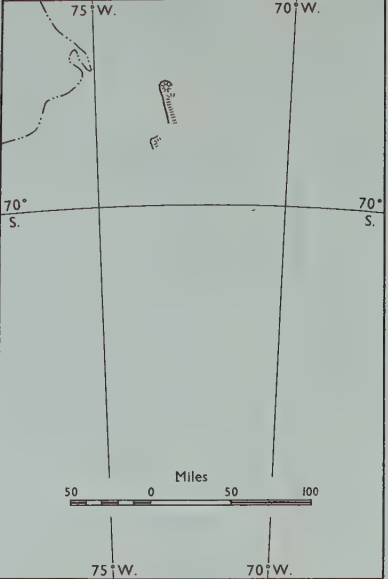
### References

- American Air Force Trimetrogon Photography, Preliminary Index, Sheet 1789.  
 Arctowski, H. 1901 'Explorations of Antarctic lands'. *Antarctic Manual*, ed. George Murray. R.G.S., London.  
 Antarctic Place-names Committee 1960 *Papers* APC(60)34, APC(60)42 and APC(60)44.  
 Belgian Antarctic Expedition 1899 *Geogr. J.* **13**, 6: 650-4.  
 Bongrain, M. 1914 'Description des côtes et banquises.' *Instructions nautiques*. Deuxième expédition Antarctique française (1908-10). Masson et Cie, Paris.  
 Byrd, Richard E. 1947 Our Navy explores Antarctica. *Nat. geogr. Mag.* **92**, 4: 429-522.  
 Charcot, J.-B. 1905 The French Antarctic Expedition. *Geogr. J.* **26**, 5: 497-519.  
 — 1907 *Geogr. J.* **30**, 2: 217-18.  
 — 1911 The Second French Antarctic Expedition. *Geogr. J.*, **37**, 3: 241-60.  
 — 1912 *Deuxième Expédition Antarctique Française (1908-1910)*. *Sciences physiques: Documents scientifiques. Cartes*. Masson et Cie, Paris.  
 — 1930 'Charcot Land', 1910 and 1930. *Geogr. Rev.* **20**, 3: 389-96.  
 Debenham, F. (ed) 1945 *The voyage of Captain Bellingshausen to the Antarctic Seas, 1819-21*. Vol. 2. Hakluyt Society, 2nd ser. xcii.  
 Dumont d'Urville, J. S. C. 1842 *Voyage au Pôle Sud et dans l'Océanie . . . Histoire du voyage*. Tome deuxième. Gide, Paris.  
 Directorate of Overseas Surveys 1956-8 1:200,000 series of maps of the Falkland Islands Dependencies (D.O.S. 601).  
 Ellsworth, Lincoln 1937 The first crossing of Antarctica. *Geogr. J.* **89**, 3: 193-213.  
 Fuchs, V. E. 1951 Exploration in British Antarctica. *Geogr. J.* **117**, 4: 399-421.  
 Joerg, W. L. G. 1936 The topographical results of Ellsworth's Trans-Antarctic flight of 1935. *Geogr. Rev.* **26**, 3: map, p. 455.  
 — 1937 The cartographical results of Ellsworth's Trans-Antarctic flight of 1935. *Geogr. Rev.* **27**, 3: 430-44.  
 Lecoq, G. 1905 *Travaux hydrographiques et instructions nautiques: Expédition Antarctique Belge. Resultats du voyage du S.Y. Belgica en 1897-1898-1899. Rapports scientifiques*. Buschmann, Antwerp.  
 Ronne, F. 1945 The main southern sledge journey from East Base, Palmer Land, Antarctica. *Proc. amer. Phil. Soc.* **89**, 1: 13-22.  
 — 1948 Ronne Antarctic Research Expedition, 1946-8. *Photogramm. Engng* **14**, 2: 197-205.  
 Rymill, J. R. 1938 British Graham Land Expedition. 1934-7. *Geogr. J.* **91**, 424-38.  
 Searle, D. J. H. 1961 The compilation of a reconnaissance map of Alexander Land, Antarctica, from trimetrogon air photographs. *Emp. Surv. Rev.* **16**, 119: 2-13.  
 Stephenson, A., and W. L. S. Fleming 1940 King George the Sixth Sound. *Geogr. J.* **96**, 3: 153-66.  
 Wilkins, Sir Hubert 1930 Further Antarctic explorations. *Geogr. Rev.* **20** 3: 357-88.

### Sources for the maps in Fig. 2 (opposite):

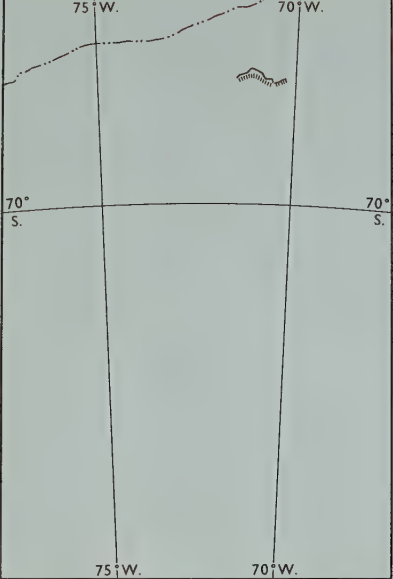
- (a) Debenham, 1945; (b) Lecoq, 1905, p. 99; (c) Charcot, 1905, map facing p. 592; (d) Charcot, 1912; (e) Wilkins, 1930, map facing p. 388; (f) Joerg, 1936, map p. 455; (g) Rymill, 1938, map facing p. 496; (h) Ronne, 1948, map facing p. 198; (j) D.O.S., series 1: 500,000 D.C.S.9 (1948-9), 1:200,000 D.O.S. 601 (1956-8) and unpublished maps.

Fig. 2 THE CHANGING MAP OF ALEXANDER AND CHARCOT ISLANDS



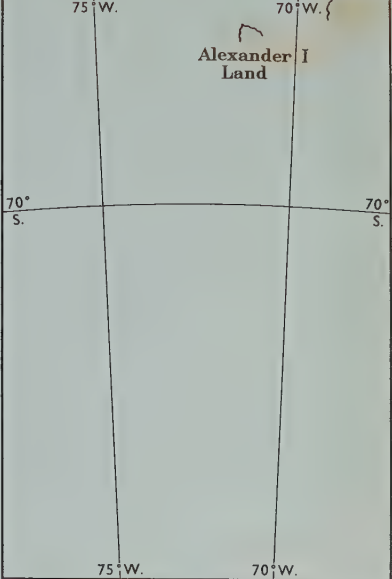
(a) 1821 Discovery and first map of Alexander Island

— — — Course of Bellingshausen's ships 'Vostok' and 'Mirnyy'

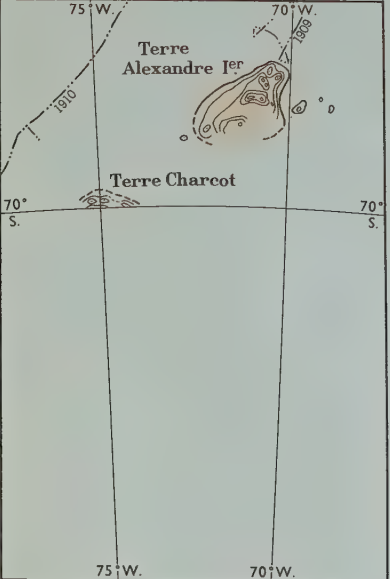


(b) 1898 Alexander Island as sketched by the Belgian Antarctic Expedition

— — — Course of Gerlache's S.Y. 'Belgica'

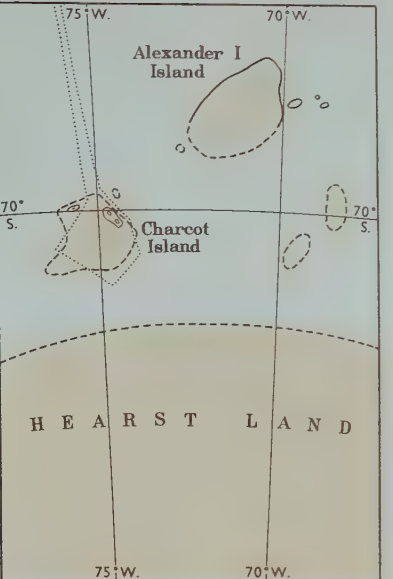


(c) 1905 Alexander Island seen and sketched from 60 miles by Charcot's first French expedition



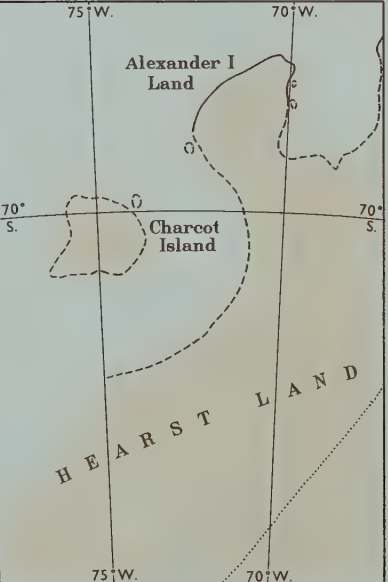
(d) 1909 and 1910 Alexander Island after the first close approach, with the discovery and first map of 'Terre Charcot' by the second French expedition

— — — Course of Charcot's ship 'Pourquoi Pas'



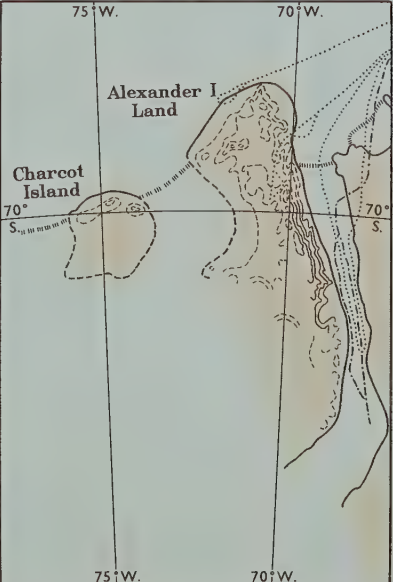
(e) 1929 The map after Sir Hubert Wilkins' flight round Charcot Island

..... Aeroplane flight line



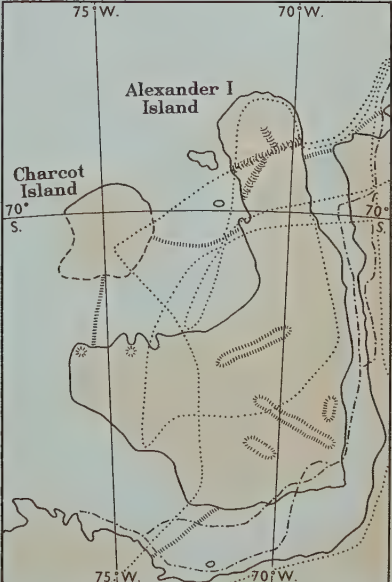
(f) 1936 Alexander Island again joined to the mainland after Lincoln Ellsworth's trans-Antarctic flight

..... Aeroplane flight line



(g) 1937 The map after the British Graham Land Expedition

..... Aeroplane flight line  
— — — Sledge traverse



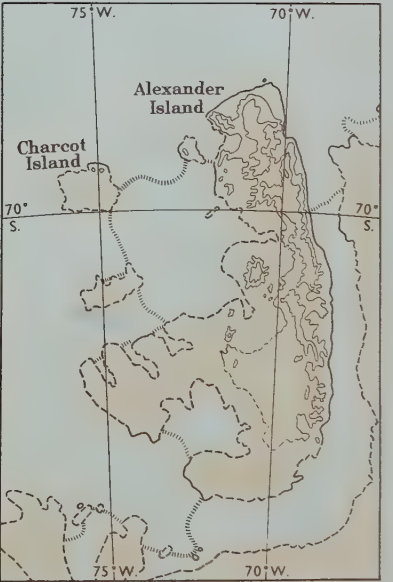
(h) 1948 Alexander Island as it appeared after the American expeditions of 1939-41, 1946-47, 1947-48

— — — Sledge traverses 1940-41 ..... Aeroplane flight lines  
(Ronne Antarctic Research Expedition only)



(i) 1950 Alexander Island as it appeared after surveys by the British Antarctic Survey (Falkland Islands Dependencies Survey) in 1948 and 1949 (see map Fig. 3)

— — — Sledge traverses



(k) 1960 Alexander and Charcot Islands as they now appear. Reduced from the new map on 1:200,000 compiled from air photographs of the Ronne Antarctic Research Expedition and Operation Highjump (see map Fig. 3)



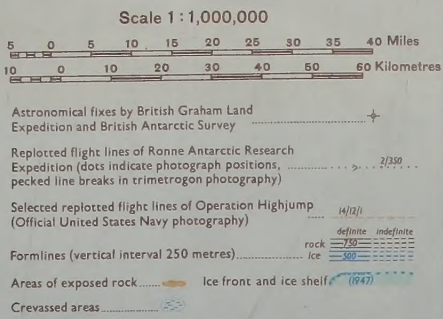


Fig. 3  
 Published by the  
 Royal Geographical Society 78

# ANTARCTIC TERRITORY AND CHARCOT ISLAND

1960 from trimetrogon air photography taken by the Ronne Antarctic Research Expedition 1947-48  
 line and adjacent detail on the east coast of Alexander Island and the west coast of Graham Land  
 Y. C. C. Brown and V. E. Fuchs (British Antarctic Survey) in 1948 and 1949, and A. Stephenson (British  
 Island was modified from a small scale chart drawn by Sir Hubert Wilkins after his flight in 1929.  
 was previously known as the Falkland Islands Dependencies Survey).





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